

## ORIGINAL ARTICLE

# The human bite injury: a clinical audit and discussion regarding the management of this alcohol fuelled phenomenon

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**Background:** Human bite injuries are both deceptive and challenging in their presentation and management. They remain a frequent presentation to our unit, most often following late night alcohol fuelled aggression. **Aims:** To audit the management of these wounds, with particular focus on infective complications and outcomes.

**Methods:** A three year retrospective chart review was undertaken on all patients referred to the plastic surgery unit from 1 January 2003 through to 31 December 2005.

**Results:** A total of 92 patients with 96 human bite wounds were identified. The majority were male (92%). Alcohol consumption was documented in 86% of cases. The majority (70%) occurred over the weekend or on a public holiday. Facial injuries made up 70% of injuries with the remainder being to the upper limb. The ear was the most common target of all facial injuries (65%). Infection was documented in 18 cases (20%), with bite injuries to the upper limb and those presenting late (>12 h) having a higher incidence of infection.

**Conclusions:** Human bite wounds present a challenge to any emergency department, given the many issues involved in their management. Underestimation of the complexity and potential sequelae of these wounds will result in a suboptimal outcome for the patient.

Human bite injuries are a relatively common referral to our plastic surgery centre. The incidence is largely unknown given that many minor injuries do not present to the emergency department for medical assessment. One of two types of injury are sustained, the occlusive bite with or without tissue loss, widely publicised with several high profile cases in the context of contact sporting events, and the more common "fight bite" or closed fist injury. Certain high risk environments have been reported, such as an increased incidence in institutionalised patients (psychiatric history and poor impulse control), those likely to be bitten as a result of occupational risk (law enforcement, institution staff) and more commonly in the context of late night, alcohol fuelled aggression.<sup>1–3</sup> Current guidelines advocate the management of these wounds as any contaminated surgical wound. This entails adequate irrigation, debridement and direct closure where possible.<sup>4</sup> Delayed closure should only be performed if the wound has been inadequately cleansed or remains visibly contaminated or infected. Prophylactic antibiotics are advised in the management of these wounds,<sup>5–8</sup> despite the lack of placebo-controlled trials to advocate their use. Referral to a specialist centre should be considered in complex hand injuries and injuries to aesthetically significant areas.

We conducted a study to examine the demographics, management and surgical outcomes following occlusive bite injuries in our unit, with particular emphasis on infective complications and need for further reconstruction of these wounds.

## METHODOLOGY

A retrospective chart review was conducted on all patients with occlusive human bite injuries assessed by the plastic surgery service at St James's Hospital, Dublin, Ireland. Records were obtained from the trauma clinic attendance logbook and hospital admission records. Patients from 1 January 2003 through to 31 December 2005 were included. Local ethics committee approval was obtained before chart review.

The following details were recorded and analysed:

- Patient demographics: age, sex, alcohol and drug consumption, date and time of incident.
- Injury demographics: site, nature of the wound, type of injury and time to presentation.
- Treatment details: wound management, viral transmission assessment, complications and follow up.

## RESULTS

A total of 92 patients were treated with occlusive human bite injuries between 1 January 2003 and 31 December 2005.

The majority of our patients were male ( $n = 85$ ) with only seven female patients, giving a male: female ratio of 12:1. Ages ranged from 16 to 57 years with a median of 22 years.

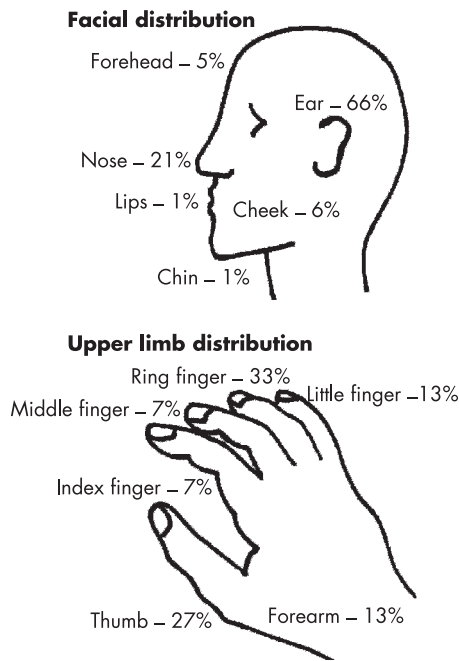
All wounds were the result of an assault, with no self-inflicted injuries reported.

Alcohol and recreational drug use at the time of the incident were documented; results are shown in table 1. The median time of injury was 03:00 h with 82% of all injuries occurring between 23:00 h and 04:00 h. The majority of incidents (70%) occurred over a weekend or public holiday.

Of the 92 patients, a total of 96 occlusive bite wounds were managed. While the majority of patients presented with one wound (95.6%), four patients sustained two separate and distinct bite wounds.

**Table 1** Alcohol and recreational drug involvement

	Involved in incident (%)	Not involved (%)
Alcohol	86	14
Recreational drugs	12	88



**Figure 1** Facial and upper limb wound distribution.

Due to the nature of our service, facial injuries accounted for 81 wounds (84%) and predominantly involved the ear (66%) with the nose, chin, cheek, forehead and lips also being targeted. The remaining 15 bite wounds (16%) were to the upper limb (fig 1). One bite injury had an associated fracture of the middle phalanx. Wounds to the ear predominantly involved the upper pole, whereas wounds to the nose were more commonly found over the nasal tip (fig 2). Various examples of wounds from presentation to management are shown in fig 3.

All wounds assessed involved breach of the integrity of the skin with tissue loss reported in 65% of cases. The remainder were complex lacerations with no avulsion of the tissue. Time to initial emergency department presentation is shown in table 2.

### Treatment details

All patients were managed with wound cleansing, tetanus prophylaxis if indicated and antibiotics. Antibiotic therapy was

initiated from the point of referral in all cases. Following assessment in our unit, intravenous antibiotics were commenced in 48 (52%) cases and oral in 44 (48%) cases. Intravenous therapy was chosen following admission in all cases; this was initiated in the presence of cellulitis or in cases requiring management in the operating theatre.

A total of 76 patients (83%) underwent washout and closure of their wounds, either primarily or by a further procedure as outlined in table 3.

Forty four patients (48%) were managed as outpatients.

Admission to our unit was arranged in 48 cases (52%) and ranged from 1–17 days, with a median length of stay of 2 days. A total of 125 bed days were consumed by these patients over the 3 year period.

### Infective complications

Infection was documented in 18 (20%) patients. This was recorded on initial assessment following referral in all cases, which varied from 1–8 days post-injury.

Criteria for inclusion in this category were assessed on a case by case basis; features such as significant spreading erythema, pain, exudate and calor were present and documented in all cases. Of the 18 patients, 13 (72%) presented to their local emergency department within 12 h of injury and five (28%) presented late (>12 h).

Occlusive bite wounds to the upper limb comprised 16% of the total wounds managed, but 39% of those who developed cellulitis. The remaining infected wounds were to the ear, nose and cheek. Patients who presented late (>12 h) had an infection rate of 29% versus 17% in those presenting within the first 12 h. While not statistically significant this does demonstrate a trend towards development of infection in these patient cohorts.

In total, 11 cases of infected facial bite wounds were recorded (14% of total facial wounds). Of these, five were assessed and diagnosed between days 2 and 8 post-injury with six cases developing cellulitis on day 1. As with all cases antibiotic treatment had been commenced from the point of referral.

All infective complications were noted at time of assessment in our unit and no patient went on to develop a second infective episode.

A total of 41% of charts had no documentation with regard viral transmission risk. Of the remaining 59%, all were commenced on a hepatitis B vaccination programme and follow up for serological testing was arranged. Antiretroviral treatment was not documented in any case and 15 patients received hepatitis B immunoglobulin.

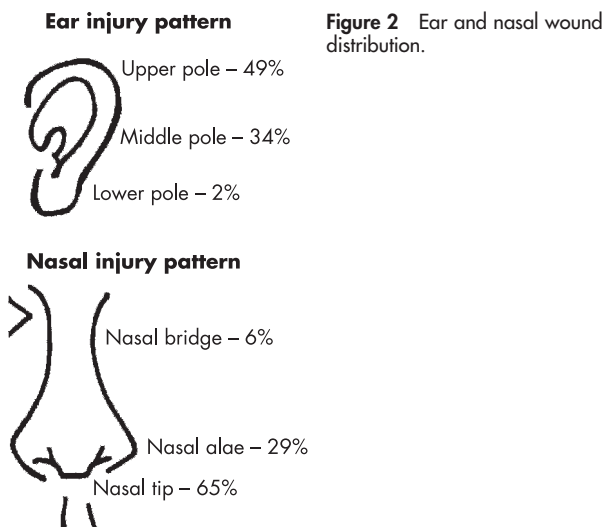
### Follow up

Outpatient follow up was initiated in all patients following initial outpatient assessment or discharge from hospital. The median length of follow up was 4 weeks (range 0–104 weeks). A total of 43 patients (47%) failed to attend for their follow up appointments.

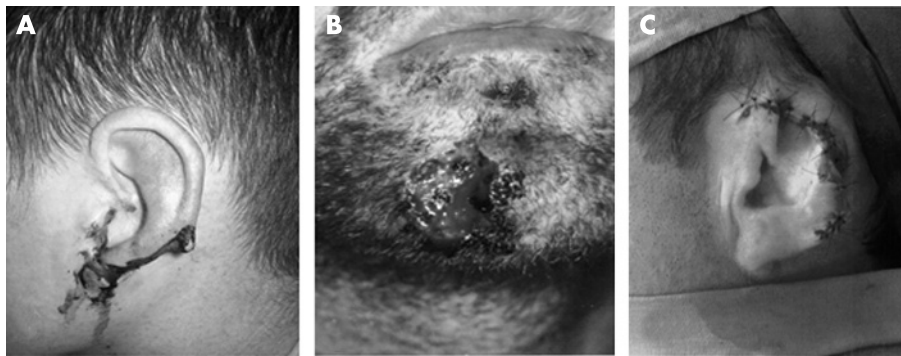
Further surgical management was also recorded. Six patients underwent reconstructive procedures (four ear defects, two nasal defects) and seven patients are awaiting reconstructive surgery, giving a total of 14% receiving further treatment. One patient underwent steroid injections of keloid scarring. All four ear defects were managed with a posterior auricular flap. Nasal reconstructions to date include a forehead flap and a conchal composite graft, both for tip defects.

### DISCUSSION

The human bite injury is a deceptive wound. The potential for infective, functional and aesthetic complications requires prompt treatment in an appropriate setting. Human bite



**Figure 2** Ear and nasal wound distribution.



**Figure 3** (A) Bite to ear (lower pole). (B) Bite to chin. (C) Bite to upper pole of ear (postoperative). Informed consent has been obtained from each individual for the purpose of publication.

injuries may present in one of two forms, the closed fist injury or the occlusive bite injury. Both are associated with male predominance and late night alcohol fuelled aggression.<sup>9 10</sup> This association was confirmed with our data.

Closed fist injuries occur when the fist strikes a tooth with sufficient force to breach the integrity of the skin. This commonly occurs over the metacarpophalangeal joint and may result in an extensor tendon injury. While local wound washout is commonly performed, the breach of the sterile and mobile tendon environment results in the bacterial load of saliva to be distributed away from the wound site. The infective and functional implications of this injury have been well documented in the literature.<sup>11 12</sup>

Occlusive bite injuries represent the less well reported subtype of human bite injuries. They occur when the teeth close over with sufficient force to breach and even avulse the tissue. They may occur in any area of the body; however, those involving the face and upper limbs should be managed in the context of a plastic surgery unit. The nature of the injury varies from superficial lacerations to wounds with tissue loss. In our study, a total of 65% of bite wounds assessed had documented tissue loss.

The potential for infective complications are well documented with a risk of local bacterial infection thought to be between 10–20%,<sup>1 6 8 11</sup> consistent with our finding of 20%. This infection rate is higher than most comparable wounds due to the considerable bacterial load of saliva, documented at over  $900 \times 10^6$  organisms/ml, with over 150 types represented.<sup>13</sup>

We looked at the factors predisposing towards infective complications. Bites to the upper limb, while not the most common site, featured highly in the infected subgroup. The upper limb was wounded in 39% of infected wounds while only being 16% of all wounds assessed. The authors suggest that the comparatively high vascularity of the face offers some protection against infection when compared to the end artery supply to the digits.

Delayed presentation (>12 h) to the emergency department was also noted to be a factor associated with increased risk of infection. Both these findings concur with previous studies.<sup>10 14 15</sup>

Viral transmission risk remains a controversial subject, given the risk of HIV or viral hepatitis transmission versus the

consequences and risks of administering prophylaxis.<sup>3 16</sup> A detailed history including risk evaluation should guide the clinician as to the appropriate level of management.

Viral hepatitis transmission has been documented in some case reports,<sup>17</sup> and it has been shown that 75% of hepatitis B patients have detectable antigen in their saliva.<sup>18</sup> Although the consensus is that transmission of HIV via a human bite is unlikely, some anecdotal reports do exist.<sup>19</sup> Exposure to saliva alone is not considered a risk factor for viral transmission, although HIV may be present in saliva (infrequently and at low levels); salivary inhibitors render the virus non-infective in the majority of cases.<sup>17 20</sup> In certain conditions leading to the exchange of infected bodily fluids, transmission is possible. This involves HIV-infected blood mixing with the saliva of the assailant and a skin break on the victim, with the reverse also being a possibility. This is where blood from an HIV-infected victim would come in contact with the mucous membranes of the biter. While not a primary focus of our study, we noted a lack of documentation concerning primary centre assessment and management of viral transmission risk. Recent correspondence in the literature<sup>21</sup> suggests a regimen for those with open wounds sustained following bite injury. Baseline testing for hepatitis B surface antigen, hepatitis C antibody, HIV-1 and HIV-2 antibodies and post-exposure prophylaxis over a course of 6 months should be recommended. In the event of the assailant's viral status being unknown, repeat testing at 6, 12 and 24 weeks is advised. Should the history suggest the absence of gross blood contamination or the viral status of the assailant is known to be negative, immediate post-exposure prophylaxis may be withheld.

Surgical management of these wounds remains a controversial area. As with all contaminated wounds, adequate washout and debridement with antibiotic cover remains the treatment of choice.<sup>4 5 7 22–24</sup> However, with facial injuries an alternative approach must be considered. We recommend a thorough washout of the wound, with primary closure once clean, in the absence of infective sequelae.<sup>4 8</sup> While potentially a devastating injury<sup>12</sup> to cosmetically important areas, our data revealed a low uptake of reconstructive procedures post-injury. While not all injuries require reconstruction, only 14% of our patients underwent, or plan to undergo, surgery. While the majority are managed satisfactorily with primary closure alone, a contributory factor to this low figure may be the high rate of non-attendance at outpatients (47%). The authors suggest, however, that many of the more minor bite injuries managed may not have required follow up in a hospital setting, thus contributing to this finding.

## Conclusion

Current opinion advocates thorough washout, debridement and primary repair of bite injuries. Antibiotic cover is recommended given the risk of infection.<sup>5</sup> Our practice is in line with this

**Table 2** Time to initial emergency department presentation

Time to initial presentation	Number (%)
<12 h	75 (82)
1–3 days	13 (14)
>4 days	4 (4)

**Table 3** Treatment details

	Method of closure	Procedure	Number	Total
<b>Local anaesthetic</b>	Primary closure		38	
	Secondary closure	Split skin graft	2	
		Full thickness skin graft	1	
				41
<b>General anaesthetic</b>	Primary closure		20	
	Secondary closure	Split skin graft	13	
		Full thickness skin graft	1	
		Debridement alone	1	
				35

management. We have shown that early presentation is a factor in decreasing the risk of infective complications and our aetiological assessment of this injury has confirmed its association with late night, alcohol fuelled aggression among young males. While cosmesis tends to be a primary concern on initial assessment of facial injuries, we have noted a poor compliance with follow up care. In conclusion, bite wounds present a challenge to any emergency department given the many issues involved in their management. Oversight of any of these issues may result in a potentially devastating complication involving function, infection or cosmesis.

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There are no competing interests involved in this study.

Informed consent was obtained for publication of fig 3

#### REFERENCES

- Lindsey D, Christopher M, Hollenbach J, et al. Natural course of the human bite wound: incidence of infection and complications in 434 bites and 803 lacerations in the same group of patients. *J Trauma* 1987;**27**:45–8.
- Gold MH, Roenigk HH, Smith ES, et al. Human bite marks. Differential diagnosis. *Clin Pediatr (Phila)* 1989;**28**:329–31.
- Pretty IA, Anderson GS, Sweet DJ. Human bites and the risk of human immunodeficiency virus transmission. *Am J Forensic Med Pathol* 1999;**20**:232–9.
- Stefanopoulos PK, Tarantzopoulou AD. Facial bite wounds: management update. *Int J Oral and Maxillofac Surg* 2005;**34**:464–72.
- Rittner AV, Fitzpatrick K, Corfield A. Best evidence topic report. Are antibiotics indicated following human bites? *Emerg Med J* 2005;**22**:654.
- Bunzli WF, Wright DH, Hoang AT, et al. Current management of human bites. *Pharmacotherapy* 1998;**18**:227–34.
- Gasser I, Osset J, Olarte J, et al. Bite wound infections: study of 22 hospitalized patients [in Spanish]. *Enferm Infecc Microbiol Clin* 1993;**11**:482–6.
- Chen E, Horing S, Shepard S, et al. Primary closure of mammalian bites. *Acad Emerg Med* 2000;**7**:157–61.
- Talan DA, Abrahamian FM, Moran GJ, et al. Clinical presentation and bacteriologic analysis of infected human bites in patients presenting to emergency departments. *Clin Infect Dis* 2003;**37**:1481–9.
- Eardley WG, Harrison MH, Coady MS. Human bite injury in the North East England – the impact of alcohol intake on a mode of violent assault. *J R Army Med Corps* 2006;**152**:22–5.
- Lindsey D, Christopher M, Hollenbach J, et al. Natural course of the human bite wound: incidence of infection and complications in 434 bites and 803 lacerations in the same group of patients. *J Trauma* 1987;**27**:45–8.
- Wienert P, Heiss J, Rinecker H, et al. A human bite. *Lancet* 1999;**354**:572.
- Mantilla Gomez S, Danser MM, Sipos PM, et al. Tongue coating and salivary bacterial counts in healthy/gingivitis subjects and periodontitis patients. *J Clin Periodontol* 2001;**28**:970–80.
- Dreyfuss UY, Singer M. Human bites of the hand: a study of one hundred six patients. *J Hand Surg [Am]* 1985;**10**(6 Pt 1):884–9.
- Baker MD, Moore SE. Human bites in children. A six-year experience. *Am J Dis Child* 1987;**141**:1285–90.
- Smith DK, Grohskopf LA, Black RJ, et al. Antiretroviral postexposure prophylaxis after sexual, injection-drug use, or other nonoccupational exposure to HIV in the United States: recommendations from the U.S. Department of Health and Human Services. *MMWR Recomm Rep* 2005;**54**(RR-2):1–20.
- Figueirdo JF, Borges AS, Martinez R, et al. Transmission of hepatitis C virus but not human immunodeficiency virus type 1 by a human bite. *Clin Infect Dis* 1994;**19**:546–7.
- Hutse V, Verhaegen E, De Cock L, et al. Oral fluid as a medium for the detection of hepatitis B surface antigen. *J Med Virol* 2005;**77**:53–6.
- Khajotia RR, Lee E. Transmission of human immunodeficiency virus through saliva after a lip bite. *Arch Intern Med* 1997;**157**:1901.
- Richman KM, Rickman LS. The potential for transmission of human immunodeficiency virus through human bites. *J Acquir Immune Defic Syndr* 1993;**6**:402–6.
- Smoot EC, Choucino CM, Smoot MZ. Assessing risks of human immunodeficiency virus transmission by human bite injuries. *Plast Reconstr Surg* 2006;**117**:2538–9.
- Donkor P, Bankas DO. A study of primary closure of human bite injuries to the face. *J Oral Maxillofac Surg* 1997;**55**:479–81.
- Ruskin JD. A study of primary closure of human bite injuries to the face – discussion. *J Oral Maxillofac Surg* 1997;**55**:481–2.
- Venter TH. Human bites of the face. Early surgical management. *S Afr Med J* 1988;**74**:277–9.